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Research Article

Antibacterial activity of some ethnomedicinal plants from the Nilgiris, Tamil Nadu, India

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Abstract

The present investigation encompasses antibacterial potential of three medicinal plants used by the tribals of Nilgiris for the treatment of various skin ailments. About 18 extracts at three concentrations (10, 5, 2.5 mg/ml) of different plant parts of ***Siegesbeckia orientalis* Linn.**, ***Berberis tinctoria* Lesch.** and ***Justicia betonica* Linn.** were tested against pathogenic bacteria, viz. *Aeromonas hydrophila, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella typhi, Salmonella* sp., *Staphylococcus aureus, Vibrio cholerae* and *V. parahemolyticus*. All the extracts exhibited broader antibacterial activity against the tested pathogens.

Keywords: Ethnomedicinal plants, Antibacterial activity, *Siegesbeckia orientalis, Berberis tinctoria, Justicia betonica,* Nilgiris.

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Introduction

Infectious diseases caused by the microbes are major health hazards all over the world. Several synthetic antibiotics and drugs are employed in the treatment of the microbial infections and communicable diseases. But the microbial pathogens develop resistance to the synthetic antibiotics. The increasing incidence of resistance to antibiotics and their side effects on the functioning of different parts of the body organ systems necessitate finding out substitutes for the antibiotics[1].

The higher plants used in ethnomedicine hold a great potential in providing solution to the problems with the use of synthetic drugs. Various chemical compounds and biological activities present in plants offer new and natural source of antibacterial agents for external use[2]. Previous studies have shown that a number of crude extracts and compounds isolated from ethnomedicinal plants are effective against pathogenic microorganisms[3-8]. However, despite enormous amount of the information on the antibacterial properties of plants available in India, various ethnomedicinal plants are yet to be explored. Hence, the present investigation was taken up with an objective to evaluate the antibacterial potential of three selected plants used by tribals in the Nilgiris.

Materials and Methods

Plant material

The plants selected for the antibacterial evaluation are used by the Irular tribes of the Nilgiris for curing wounds and skin diseases[9]. Information on ethnomedicinal uses of

Siegesbeckia orientalis

***Siegesbeckia orientalis* Linn.** , ***Berberis tinctoria* Lesch.** and ***Justicia betonica* Linn.** was elicited by conducting expeditions during the period of September 2001 to June 2002. The collected plants were identified with the help of Flora of Madras Presidency[10] and authenticated with herbarium of Government of India, Botanical Survey of India (Southern Circle), Coimbatore. All the voucher specimens were deposited in the Department of Botany, Bharathiar University, Coimbatore.

Preparation of extracts

Freshly collected plant materials such as leaves of ***S. orientalis***, roots of ***B. tinctoria*** and leaves of ***J. betonica*** were dried in shade in well-ventilated enclosures. Dried plant materials were powdered in a Wiley Mill (Scientific Equipment Works, New Delhi, India) to 60-mesh size. Fifty grams of each powder was extracted with the 250ml solvents in the increasing order of their polarity, viz. petroleum ether, benzene, chloroform, ethyl acetate, methanol and water. The extracts, thus collected, were evaporated to dryness under reduced pressure. Three concentrations 10, 5 and 2.5mg/ml were prepared from the crude extracts and tested against pathogenic microorganisms.

Evaluation of antibacterial activity

The bacterial pathogens such as *Aeromonas hydrophila* MTCC 646, *Escherichia coli* MTCC 443, *Salmonella typhi* MTCC 734, *Staphylococcus aureus* subsp. *aureus* MTCC 737 were procured from Institute of Microbial Technology, Chandigarh, India. Other microbes, *Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella* sp., *Vibrio cholerae* and *V. parahemolyticus* were clinical isolates obtained from Department of Environmental Sciences, Bharathiar University, Coimbatore. Each organism was sub-cultured on Mueller Hinton Agar medium at 27ºC for 24 hours and stored at 4ºC to maintain stock culture. Antibacterial assay of different organic, alcoholic and aqueous extracts was determined by disc diffusion method[11]. The extracts were added in the different concentrations of 10, 5 and 2.5mg/ml to the sterilized Whatman filter paper discs and agar plates. Chloramphenicol antibiotic disc was used as positive control. Finally, the plates were incubated for 18 hours at 37ºC depending on the optimal growth. After 18 hours the inhibition zones were measured.

Justicia betonica

Results and Discussion

A total number of 18 extracts at three concentrations (10, 5, 2.5 mg/ml) of above three plants were tested for their antibacterial activity against nine pathogenic bacteria. Tables 1-3 represent the summary of the antibacterial activities of various extracts with respect to each of the test organism at different concentrations.

Leaf extracts of ***S. orientalis*** (Table 1) showed broader antibacterial activity against tested microbial pathogens. Benzene extract of the plant exhibited higher activity against *S. aureus* followed by chloroform extract against *V. cholerae*. Earlier reports suggested that the petroleum ether, dichloromethane, ethyl acetate and unfractionated ethanol extracts of ***S. orientalis*** showed moderate activity against *S. aureus, E. coli, K. pneumoniae, P. aeruginosa* and *S. typhi*[12]. Leaf extracts of this plant showed significant antifeedant activity against *Crocidolomia binotalis*[13]. The root extracts of ***B. tinctoria*** (Table 2) exhibited significant antibacterial activity against six bacteria tested with maximum activity against *P. aeruginosa* and *E. coli*. The pathogens *A. hydrophila*, *V. cholerae* and *V. parahemolyticus* were found to be resistant against all the extracts. Earlier, it was demonstrated that in ***B. tinctoria*** except root extract other plant part extracts were inactive against the tested pathogens[14]. All the leaf extracts of ***J. betonica*** (Table 3) at all the employed concentrations showed moderate activity against the tested microorganisms. The extracts failed to inhibit the growth of *K. pneumoniae, S. typhi* and *V. cholerae.* However, leaf extracts of the plant is reported to be active against rice moth, *Coraryra*[15].

Table 1 : Antibacterial activity of leaf extracts of *Siegesbeckia orientalis*

Extracts	Concentration (mg/ml)	Inhibition zone (mm)								
		V. cholerae	*V. parahaemolyticus*	*E. coli*	*S. typhi*	*Salmonella* sp.	*S. aureus*	*K. pneumoniae*	*A. hydrophilla*	*P. aeruginosa*
Petroleum ether	10	14	12	13	21	-	12	11	23	20
	5	13	11	11	20	-	9	8	21	17
	2.5	8	9	9	19	-	8	7	15	13
Benzene	10	15	23	20	25	20	30	20	27	22
	5	13	16	16	12	15	20	10	23	22
	2.5	7	14	-	11	13	18	7	22	16
Chloroform	10	30	12	28	24	-	-	-	21	24
	5	16	8	15	7	-	-	-	14	14
	2.5	9	7	10	-	-	-	-	9	12
Ethyl acetate	10	22	15	21	19	15	11	14	18	21
	5	13	12	12	15	-	10	9	16	20
	2.5	10.	10	9	10	-	9	7	13	18
Methanol	10	10	12	11	10	-	12	10	25	17
	5	8	9	9	8	-	10	7	15	16
	2.5	7	7	7	8	-	8	-	10	8
Hot water	10	10	-	11	-	-	-	8	-	14
	5	-	-	-	-	-	-	-	-	-
	2.5	-	-	-	-	-	-	-	-	-
Chloram-phenicol*	30 µg/disc	27	28	27	26	25	26	24	30	24

*Reference compound

Table 2 : Antibacterial activity of root extracts of *Berberis tinctoria*

Extracts	Concentration (mg/ml)	Inhibition zone (mm)								
		V. cholerae	*V. parahaemolyticus*	*E. coli*	*S. typhi*	*Salmonella* sp.	*S. aureus*	*K. pneumoniae*	*A. hydrophilla*	*P. aeruginosa*
Petroleum ether	10	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-
	2.5	-	-	-	-	-	-	-	-	-
Benzene	10	-	-	10	19	-	-	18	-	20
	5	-	-	-	-	-	-	-	-	-
	2.5	-	-	-	-	-	-	-	-	-
Chloroform	10	-	-	10	20	17	15	20	15	25
	5	-	-	8	18	9	-	-	-	13
	2.5	-	-	-	-	-	-	-	-	-
Ethyl acetate	10	-	-	15	-	14	-	16	-	20
	5	-	-	13	-	12	-	10	-	19
	2.5	-	-	-	-	10	-	-	-	-
Methanol	10	-	-	17	11	18	-	14	-	20
	5	-	-	10	10	10	-	9	-	15
	2.5	-	-	-	-	-	-	-	-	-
Hot water	10	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-
	2.5	-	-	-	-	-	-	-	-	-
Chloram-phenicol*	30 µg/disc	27	28	27	26	25	26	24	30	24

*Reference compound

Table 3 : Antibacterial activity of leaf extracts of *Justicia betonica*

Extracts	Concentration (mg/ml)	Inhibition zone (mm)								
		V. cholerae	*V. parahaemolyticus*	*E. coli*	*S. typhi*	*Salmonella* sp.	*S. aureus*	*K. pneumoniae*	*A. hydrophilla*	*P. aeruginosa*
Petroleum ether	10	-	-	-	16	-	-	-	-	9
	5	-	-	-	10	-	-	-	-	-
	2.5	-	-	-	-	-	-	-	-	-
Benzene	10	-	13	13	22	-	16	-	17	18
	5	-	11	12	18	-	12	-	15	17
	2.5	-	7	11	15	-	10	-	10	14
Chloroform	10	-	11	17	26	-	10	-	17	20
	5	-	10	16	20	-	9	-	16	19
	2.5	-	-	11	18	-	-	-	14	13
Ethyl acetate	10	-	-	11	18	-	-	-	15	18
	5	-	-	10	16	-	-	-	10	15
	2.5	-	-	-	15	-	-	-	8	13
Methanol	10	-	-	12	18	-	10	-	18	18
	5	-	-	10	13	-	-	-	17	12
	2.5	-	-	8	8	-	-	-	-	-
Hot water	10	-	7	-	15	-	10	-	24	12
	5	-	-	-	-	-	-	-	-	-
	2.5	-	-	-	-	-	-	-	-	-
Chloram-phenicol*	30 µg/disc	27	28	27	26	25	26	24	30	24

*Reference compound

Conclusion

The evaluation of antibacterial activity of different extracts of ethnomedicinal plants curing wounds and skin diseases of Irulars reveal that the plants possess potential antibacterial activity against the pathogenic bacteria. It also showed that the traditional therapeutic index of the plants studied appeared to have a good degree of correlation with their specific antibacterial property. The results obtained in this screening justify continuing with the purification of crude extracts and isolation of active principles for improving their potential as antibacterial drugs and/new lead molecules.

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